

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
5 July 2001 (05.07.2001)

PCT

(10) International Publication Number
WO 01/048619 A3

(51) International Patent Classification⁷: **G06F 13/16**, 9/38

(21) International Application Number: PCT/US00/42663

(22) International Filing Date: 6 December 2000 (06.12.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/473,112 28 December 1999 (28.12.1999) US

(63) Related by continuation (CON) or continuation-in-part (CIP) to earlier application:

US 09/473,112 (CON)
Filed on 28 December 1999 (28.12.1999)

(71) Applicant (for all designated States except US): **INTEL CORPORATION** [US/US]; 2200 Mission College Boulevard, Santa Clara, CA 95052 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **WOLRICH, Gilbert** [US/US]; 4 Cider Mill Road, Framingham,

MA 01701 (US). **BERNSTEIN, Debra** [US/US]; 443 Peakham Road, Sudbury, MA 01776 (US). **ADILETTA, Matthew, J.** [US/US]; 20 Monticello Drive, Worcester, MA 01603 (US). **WHEELER, William** [US/US]; 9 Darlene Drive, Southborough, MA 01772 (US).

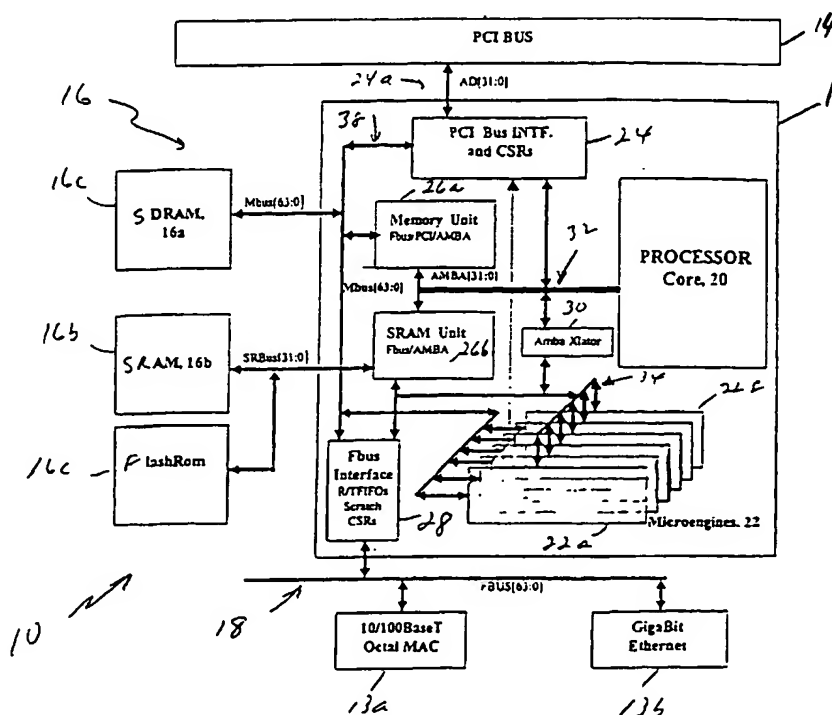
(74) Agent: **HARRIS, Scott, C.**; Fish & Richardson P.C., Suite 500, 4350 La Jolla Village Drive, San Diego, CA 92122 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: **DISTRIBUTED MEMORY CONTROL AND BANDWIDTH OPTIMIZATION**



(57) Abstract: A controller for a random access memory has control logic, including an arbiter that detects a status of outstanding memory references. The controller selects a memory reference from one of a plurality of queues of memory references. The control logic is responsive to a memory reference chaining bit that when set allows for special handling of contiguous memory references.



Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(88) Date of publication of the international search report:

14 November 2002

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 G06F13/16 G06F9/38		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 7 G06F		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ, IBM-TDB		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 940 866 A (CHISHOLM ET AL) 17 August 1999 (1999-08-17) column 2, line 25 -column 3, line 7 column 5, line 5 -column 7, line 37 column 8, line 8 -column 9, line 10 claims 4,5; figure 3 ---	1,7-12, 16-20
A	US 5 784 712 A (BYERS ET AL) 21 July 1998 (1998-07-21) column 3, line 38 -column 6, line 44 figures 4-6 ---	1-4, 12-16,20
A	EP 0 379 709 A (IBM CORPORATION) 1 August 1990 (1990-08-01) column 2, line 47 -column 3, line 21 column 4, line 6 -column 5, line 30 --- -/--	1-4, 12-16,20
<div style="display: flex; justify-content: space-between;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex. </div>		
* Special categories of cited documents: <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>*A* document defining the general state of the art which is not considered to be of particular relevance</p> <p>*E* earlier document but published on or after the international filing date</p> <p>*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>*O* document referring to an oral disclosure, use, exhibition or other means</p> <p>*P* document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 48%;"> <p>*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>*Z* document member of the same patent family</p> </div> </div>		
Date of the actual completion of the international search <div style="text-align: center; font-weight: bold;">2 August 2002</div>		Date of mailing of the international search report <div style="text-align: center; font-weight: bold;">09/08/2002</div>
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer <div style="text-align: center; font-weight: bold;">McDonagh, F</div>

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 905 876 A (PAWLOWSKI ET AL) 18 May 1999 (1999-05-18) column 2, line 55 -column 3, line 30 column 5, line 15 -column 6, line 3 figures 1,2 -----	5,6

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5940866	A	17-08-1999	NONE	
US 5784712	A	21-07-1998	NONE	
EP 379709	A	01-08-1990	US 5046000 A DE 68923951 D1 DE 68923951 T2 EP 0379709 A2 JP 2234543 A	03-09-1991 28-09-1995 18-04-1996 01-08-1990 17-09-1990
US 5905876	A	18-05-1999	NONE	